

of Residential Central Furnaces and Boilers,” sections 7.2.2.4, 7.8, 9.2, and 11.3.7, approved June 27, 2007, IBR approved for § 431.76.

(2) [Reserved]

(d) *HI*. Hydronics Institute Division of AHRI, 35 Russo Place, P.O. Box 218, Berkeley Heights, NJ 07922, (703) 600-0350, or go to: <http://www.ahrinet.org/hydronics+institute+section.aspx>.

(1) HI BTS-2000, sections 8.2.2, 11.1.4, 11.1.5, and 11.1.6.2, “*Method to Determine Efficiency of Commercial Space Heating Boilers*,” published January 2001, IBR approved for § 431.76.

(2) [Reserved]

(e) *UL*. Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062, (847) 272-8800, or go to: <http://www.ul.com>.

(1) UL 727 (UL 727-1994), “*Standard for Safety Oil-Fired Central Furnaces*,” published on August 1, 1994, IBR approved for § 431.76.

(2) UL 727 (UL 727-2006), “*Standard for Safety Oil-Fired Central Furnaces*,” approved April 7, 2006, IBR approved for § 431.76.

(3) [Reserved]

[77 FR 28987, May 16, 2012, as amended at 80 FR 42663, July 17, 2015]

**§ 431.76 Uniform test method for the measurement of energy efficiency of commercial warm air furnaces.**

(a) *Scope*. This section covers the test requirements used to measure the energy efficiency of commercial warm air furnaces with a rated maximum input of 225,000 Btu per hour or more. On and after July 11, 2016, any representations made with respect to the energy use or efficiency of commercial warm air furnaces must be made in accordance with the results of testing pursuant to this section. At that time, you must use the relevant procedures in ANSI Z21.47 or UL 727-2006 (incorporated by reference, see § 431.75). On and after August 17, 2015 and prior to July 11, 2016, manufacturers must test commercial warm air furnaces in accordance with this amended section or the section as it appeared at 10 CFR part 430, subpart B in the 10 CFR parts 200 to 499 edition revised January 1, 2014. DOE notes that, because testing under this section is required as of July 11, 2016, manufacturers may wish to begin using this

amended test procedure immediately. Any representations made with respect to the energy use or efficiency of such commercial warm air furnaces must be made in accordance with whichever version is selected.

(b) *Testing*. Where this section prescribes use of ANSI Z21.47 or UL 727-2006 (incorporated by reference, see § 431.75), perform only the procedures pertinent to the measurement of the steady-state efficiency, as specified in paragraph (c) of this section.

(c) *Test set-up*. (1) *Test set-up for gas-fired commercial warm air furnaces*. The test set-up, including flue requirement, instrumentation, test conditions, and measurements for determining thermal efficiency is as specified in sections 1.1 (Scope), 2.1 (General), 2.2 (Basic Test Arrangements), 2.3 (Test Ducts and Plenums), 2.4 (Test Gases), 2.5 (Test Pressures and Burner Adjustments), 2.6 (Static Pressure and Air Flow Adjustments), 2.39 (Thermal Efficiency), and 4.2.1 (Basic Test Arrangements for Direct Vent Central Furnaces) of ANSI Z21.47 (incorporated by reference, see § 431.75). The thermal efficiency test must be conducted only at the normal inlet test pressure, as specified in section 2.5.1 of ANSI Z21.47, and at the maximum hourly Btu input rating specified by the manufacturer for the product being tested.

(2) *Test setup for oil-fired commercial warm air furnaces*. The test setup, including flue requirement, instrumentation, test conditions, and measurement for measuring thermal efficiency is as specified in sections 1 (Scope), 2 (Units of Measurement), 3 (Glossary), 37 (General), 38 and 39 (Test Installation), 40 (Instrumentation, except 40.4 and 40.6.2 through 40.6.7, which are not required for the thermal efficiency test), 41 (Initial Test Conditions), 42 (Combustion Test—Burner and Furnace), 43.2 (Operation Tests), 44 (Limit Control Cutout Test), 45 (Continuity of Operation Test), and 46 (Air Flow, Downflow or Horizontal Furnace Test), of UL 727-2006 (incorporated by reference, see § 431.75). You must conduct a fuel oil analysis for heating value, hydrogen content, carbon content, pounds per gallon, and American Petroleum Institute (API) gravity as specified in section 8.2.2 of HI BTS-2000 (incorporated

by reference, see § 431.75). The steady-state combustion conditions, specified in Section 42.1 of UL 727-2006, are attained when variations of not more than 5 °F in the measured flue gas temperature occur for three consecutive readings taken 15 minutes apart.

(d) *Additional test measurements*—(1) *Measurement of flue CO<sub>2</sub> (carbon dioxide) for oil-fired commercial warm air furnaces.* In addition to the flue temperature measurement specified in section 40.6.8 of UL 727-2006 (incorporated by reference, see § 431.75), you must locate one or two sampling tubes within six inches downstream from the flue temperature probe (as indicated on Figure 40.3 of UL 727-2006). If you use an open end tube, it must project into the flue one-third of the chimney connector diameter. If you use other methods of sampling CO<sub>2</sub>, you must place the sampling tube so as to obtain an average sample. There must be no air leak between the temperature probe and the sampling tube location. You must collect the flue gas sample at the same time the flue gas temperature is recorded. The CO<sub>2</sub> concentration of the flue gas must be as specified by the manufacturer for the product being tested, with a tolerance of ±0.1 percent. You must determine the flue CO<sub>2</sub> using an instrument with a reading error no greater than ±0.1 percent.

(2) *Procedure for the measurement of condensate for a gas-fired condensing commercial warm air furnace.* The test procedure for the measurement of the condensate from the flue gas under steady-state operation must be conducted as specified in sections 7.2.2.4, 7.8, and 9.2 of ASHRAE 103 (incorporated by reference, see § 431.75) under the maximum rated input conditions. You must conduct this condensate measurement for an additional 30 minutes of steady-state operation after completion of the steady-state thermal efficiency test specified in paragraph (c) of this section.

(e) *Calculation of thermal efficiency*—(1) *Gas-fired commercial warm air furnaces.* You must use the calculation procedure specified in section 2.39, Thermal Efficiency, of ANSI Z21.47 (incorporated by reference, see § 431.75).

(2) *Oil-fired commercial warm air furnaces.* You must calculate the percent

flue loss (in percent of heat input rate) by following the procedure specified in sections 11.1.4, 11.1.5, and 11.1.6.2 of the HI BTS-2000 (incorporated by reference, see § 431.75). The thermal efficiency must be calculated as: Thermal Efficiency (percent) = 100 percent - flue loss (in percent).

(f) *Procedure for the calculation of the additional heat gain and heat loss, and adjustment to the thermal efficiency, for a condensing commercial warm air furnace.*

(1) You must calculate the latent heat gain from the condensation of the water vapor in the flue gas, and calculate heat loss due to the flue condensate down the drain, as specified in sections 11.3.7.1 and 11.3.7.2 of ASHRAE 103 (incorporated by reference, see § 431.75), with the exception that in the equation for the heat loss due to hot condensate flowing down the drain in section 11.3.7.2, the assumed indoor temperature of 70 °F and the temperature term T<sub>OA</sub> must be replaced by the measured room temperature as specified in section 2.2.8 of ANSI Z21.47 (incorporated by reference, see § 431.75).

(2) *Adjustment to the thermal efficiency for condensing furnaces.* You must adjust the thermal efficiency as calculated in paragraph (e)(1) of this section by adding the latent gain, expressed in percent, from the condensation of the water vapor in the flue gas, and subtracting the heat loss (due to the flue condensate down the drain), also expressed in percent, both as calculated in paragraph (f)(1) of this section, to obtain the thermal efficiency of a condensing furnace.

[80 FR 42663, July 17, 2015]

#### ENERGY CONSERVATION STANDARDS

#### § 431.77 Energy conservation standards and their effective dates.

(a) *Gas-fired commercial warm air furnaces.* Each gas-fired commercial warm air furnace must meet the following energy efficiency standard levels:

(1) For gas-fired commercial warm air furnaces manufactured starting on January 1, 1994, until January 1, 2023, the TE at the maximum rated capacity (rated maximum input) must be not less than 80 percent; and

(2) For gas-fired commercial warm air furnaces manufactured starting on